3D BURST SIMULATION OF PIPELINE CONTAINING HIGH-PRESSURE NATURAL GAS ON PC CLUSTER

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This paper describes a 3D finite element simulation of long pipeline containing high pressure natural gas. The natural gas in the pipeline is modeled as one-dimensional phase transforming liquid. That is, the natural gas transforms from liquid to gas in accordance with decrease of pressure. On the other hand, the pipeline is modeled as three-dimensional elastic-plastic solid structure containing a fast propagating crack, whose speed is in the range of 120-200 m/sec. This phenomena is solved as a weak-coupled fluid-structure problem. The finite element mesh of the pipeline part has one million degrees of freedom. The structure part is solved using a parallel finite element system named ADVENTURE cluster, developed by some of the present authors [1]. This is a fully parallelized finite element code and employs a course-grid conjugate gradient method. Taking crack propagation profiles from burst experiments. We have performed generation phase analyses. Some fracture criteria such as crack tip opening angle and energy release rate are examined. Conditions for sustained propagation of crack are examined in detail.

Fig. 1 Mesh near the propagating crack front.

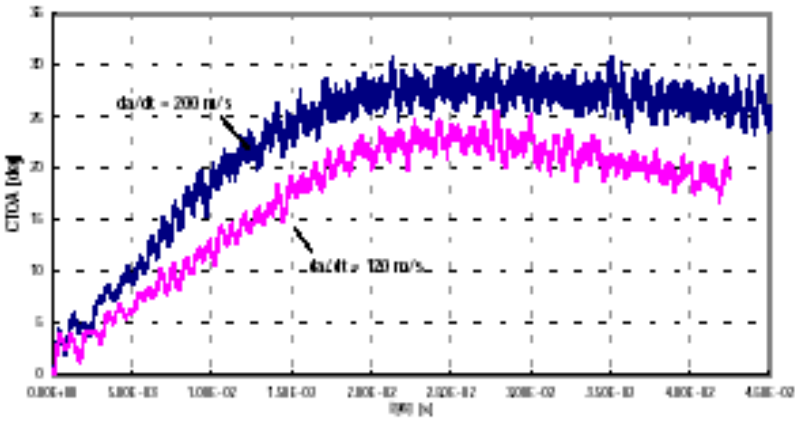

Fig. 2 Time variation of CTOA for generation phase analysis

References

[1] S. Yoshimura, R. Shioya, H. Noguchi and T. Miyamura , Advanced General-purpose Computational Mechanics System for Large Scale Analysis and Design, *Journal of Computational and Applied Mathematics*, Vol.149, pp.279-296, (2002).